What We've Learned About Growing High Density Sweet Cherries in the East.

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Over last few years there have been a number of advances in sweet cherry culture including the introduction of dwarfing cherry rootstocks, newer varieties, high density training systems, and rain covers which are helping to solve the major problems that plague Eastern US cherry growers. Although producing cherries using dwarfing rootstocks and high density orchards is still challenging, over the last 10 years we have developed several management techniques to overcome these issues.

Plant High Tree Densities

Yields of fruit orchards are strongly related to tree planting density. The low yields of traditional sweet cherry orchards can be improved substantially with high density orchards however growers have little experience with high density cherry orchards. Several high density training systems have been developed for sweet cherries including the Vogel Slender Spindle, the Zahn Vertical Axis, the Spanish Bush, the Steep Leader Vase, and the V-trellis tree system. We have compared 5 high-density production systems on both standard and dwarfing rootstocks for sweet cherries over the last 8 years.

Among the six systems we tested, the highest cumulative yield/acre over 8 years was with the Vertical axis system (28 tons/acre), followed by the Slender spindle and the V systems (24 tons/acre), the Spanish bush system (19 tons/acre), and the Central leader system (13 tons/acre). The differences in yield between systems were largely a function of tree density. There was a linear relationship of tree planting density and yield (Fig. 1). The Vertical axis system, and to a lesser extent the Slender spindle system, had a higher cumulative yield than expected from their tree density. The large differences in yield resulted in a 3 fold difference in cumulative crop value between the Vertical Axis system and the traditional low-density Central Leader system. With current rootstocks new cherry orchards should be planted at densities of at least 300 trees/acre and with new advances we envision orchard up to 800 trees/acre.

Dwarfing Rootstocks

Trees on 'Gi.5' were significantly smaller (21%) than trees on 'Gi.6' which in turn was about 9% smaller than trees on 'MXM.2'. In addition, the Gisela trees had a more "calm" appearance which makes them more suited to high planting densities. We estimate that trees on Gisela 5 should be planted at densities from 400-800 trees/acre while Gisela 6 should be planted at densities from 300-500 trees/acre.

Rootstocks had a large influence on cropping in the first 8 years of our trial. With Hedelfinger, 'Gi.5' had the greatest cumulative yield (127 lb/tree) while 'Gi.6' was intermediate (106 lb/tree) and 'MXM.2' had the lowest yield (28 lb/tree). The 'Gisela 5' trees had 10 times the yield as the vigorous 'MxM.2' trees in the fourth year and 4 times the cumulative yield after 8 years. The 'Gisela 6' trees had about 7 times the yield of the 'MxM.2' trees in the fourth year and 3.5 times the cumulative yield after 8 years. However, the large crops on 'Gi.5' were have been excessive since fruit size was reduced compared to Gi.6.

With 'Hedelfinger', the 'Gi.6' trees had larger fruit size and higher fruit soluble solids than the standard sized 'MxM.2' trees indicating that they were not been over-cropped. In contrast, the 'Gi.5' trees had such large crops that fruit size and soluble solids were both lower than with the 'Gi.6' trees. With self fruitful varieties such as 'Sweetheart' and 'Lapins', trees on Gi.5 had excessive crops which will require that crop load be managed through pruning or thinning to achieve large fruit size. Modified pruning strategies such as spur extinction pruning or heading of all one-year-old shoots will be required to achieve marketable fruit size with Gi.5 and highly fruitful varieties.

New Varieties

Performance of cherry varieties across eastern North America can vary widely due to soil and climatic differences. Our suggestions of new sweet cherry varieties are ones that have done well in our research orchards.

Early Season Varieties

Cavalier™ (Rynbrandt cv.) –This early ripening cherry has high quality, firm, medium-sized dark red fruit. It should be planted on Gisela rootstocks since it has low productivity on vigorous rootstocks. Bacterial canker tolerance and winter hardiness are both good, as is resistance to cracking. Self-infertile, in Pollen Group IV (S_2S_3), with an early bloom season; multiple pollenizers are recommended.

Chelan® – This early ripening cherry has moderate quality, dark mahogany red, firm, moderate to large size fruit. For best flavor, fruit must be allowed to ripen fully. Productivity is very good, resistance to cracking is fairly good, and trees are resistant to powdery mildew. Self-infertile, in Pollen Group XVI (S_3S_9), with an early bloom season.

Kristin - This early-to-mid season ripening cherry has moderate sized, firm dark red, flavorful fruit. Winter hardiness is excellent, and fruit have moderate to good resistance to rain-induced fruit cracking. Self-infertile, in Pollen Group III (S_3S_4), with an early-to-mid bloom season.

Mid Season Varieties

Benton® (Columbia) – This mid-season ripening cherry has dark mahogany red, firm, large size fruits with very good flavor. Performance has been consistently high in trials in New York. Resistance to cracking is fairly good. It is self-fertile, with a mid-to-late bloom season.

WhiteGold® - This mid-season ripening blush cherry has light yellow-fleshed with a red-on-yellow skin blush fruits which are firm, with moderate-to-large size, good flavor. Trees are very productive, cold hardy and well-adapted to the growing conditions of eastern North America, with a very low susceptibility to cherry leaf spot and bacterial canker. Fruit are moderately tolerant of rain. Self-fertile, with a mid-to-late bloom season.

Glacier® - This mid-season ripening cherry has very large fruits which are dark mahogany red with very good flavor but less firmness than other fresh market varieties. `Glacier' could be an outstanding fruit for local fresh markets. It should be grown on precocious, size-controlling rootstocks. Moderately susceptible to rain-cracking. Self-fertile, with a mid-to-late bloom season.

Lapins - This mid-season ripening cherry has large fruits which are dark mahogany red with very good flavor and excellent firmness. Lapins produces outstanding fruit for immediate local sales. It has had surface pitting problems when shipped from the west coast. In NY it has also suffered from winter injury in 2003 and 2004. Nevertheless it is an outstanding self fertile, productive variety that is quite tolerant to rain-cracking.

Late Season Varieties

Regina. This late season ripening cherry is the most promising new variety for the East. Fruits are large, dark red, very firm with a long stem. It is quite tolerant of rain-cracking. It is a late blooming which helps it escape frosts but it requires a pollenizer variety that also blooms late. Hudson, have performed very well in our trials at Geneva. It is a shy cropper unless grown on one of the Gisela stocks. Its late bloom

Sweetheart - This very late ripening season cherry is the best for the end of the season. Fruits are very high quality, bright red, firm and have good flavor, but size is only moderate. A very grower-friendly tree, with a spreading tree form and precocious, heavy cropping on all rootstocks. It has good winter hardiness and bacterial canker susceptibility and fruit are moderately resistant to cracking. The tree is self-fertile, with an mid-season bloom. On Gisela rootstocks it is often too productive and requires crop load management to achieve acceptable size.

Keeping Trees Alive - The saying goes that "Cherry trees love to die". With the heavier soils in New York often cherry tree survival is poor. There are 4 important management approaches we have utilized to limit tree mortality.

Plant trees on 12" high berms Tree death in sweet cherries is often associated with winter damage and excessive soil moisture. In some cases the death is caused by phytophthora root rot and in other cases it is caused by winter injury. We have found that planting trees on 12" high berms results in significantly better tree growth and survival than without berms. This is likely due to better soil oxygen levels and to reduced water logging in the fall and in the spring. An important note is that trees planted on berms must be irrigated with a single trickle line down the tree row. The berms can dry out quickly during hot weather in the summer.

Use intensive soil tiling Often winter damage of cherry trees is associated with wet areas in a field. Intensive tiling down every row middle has resulted in much less winter damage of cherries. In our plots we installed a subsurface tile line in the center of each tractor alley to remove excess moisture in the fall and spring and to rapidly remove excess water following heavy rainfall before harvest. The rapid removal of excess water near harvest also helps limit fruit cracking.

Use resistant rootstocks. None of the currently available cherry rootstocks is resistant to phytophthora root rot; however, the Gisela rootstocks show greater tolerance than do Maheleb or Mazzard. In our plots we have lost 18% of the trees on Mazzard and 8% of the trees on Mahaleb but only 1.4%, 1.6% and 4% of the trees on Gi.5, Gi.6, and Gi.12 respectively.

Control bacterial canker. In the humid climate of NY state it is important to plant varieties that are less susceptible to bacterial canker. In addition 3 management practice are important to avoiding tree death due to canker. (a) pruning should be delayed until growth starts or do all of the pruning postharvest in late July. (b) use a copper spray program that includes 2 sprays in the

fall near leaf drop (20% leaf drop and 90% leaf drop) and 2 sprays in the spring at bud break and immediately following pruning if pruning is done in the spring. (c) never make flush cuts on the leader. Always leave a 6-8" stub. If canker gets in this stub it will progress slowly toward the trunk but will not girdle the trunk. Flush cuts led to serious canker infections on the trunk while leaving a stub prevented infections on the trunk. We have made it a strict rule to always leave a 6" stub when cutting on the main trunk of the tree and never allowing flush cuts.

Training And Pruning Young Sweet Cherries

Traditionally sweet cherries receive little training and pruning for the first five years. However, with high density orchards, investments in proper tree training pay dividends. In addition starting with the right tree will result in higher early production. Our trials with sweet cherries have shown.

Plant a high quality tree. The optimum tree to plant differs by system. For the Vertical Axis, Slender Spindle and Central Leader systems a large caliper highly feathered tree is the best and requires little pruning and training during the first few years. The larger caliper feathered tree used in the Vertical Axis and Slender Spindle systems have much greater production in the third –fifth years than a small caliper tree. For the Spanish Bush, Perpendicular V and the Steep Leader systems a medium caliper whip is better since these 3 systems employ severe heading of the leader at planting.

Minimize heading cuts for the first few years. Repeated pruning cuts in the first 3 years reduces yield whereas minimal pruning during the first 3 years results in high early yield. The Spanish Bush requires heading cuts two times per year for 3 years to form the bush and as a consequence it has lower early yield. The Perpendicular V and the Marchand trellis also employ significant early pruning. In contrast the Vertical Axis utilizes almost no pruning for 3 years. The Vogel Slender Spindle system gives intermediate yields since it requires annual heading of the leader to develop side branches and limit tree height.

Develop side branches without heading. To successfully incorporate minimal pruning on young sweet cherry trees requires specialized branching techniques to overcome the strong apical dominance. The lack of heading the leader often results in blind wood and limited lateral branching on the leader. There are 2 methods of stimulating lateral branching along the leader: 1) Notching above every 3rd bud along the leader with a saw blade at bud swell combined with Promalin (5,000ppm) sprayed on the cuts at bud swell, and 2)Bud Removal of 2/3 of the buds along the leader (every third bud was left and the others were rubbed out at bud swell). Promalin and notching have not been very effective unless combined. However, bud removal has very effective and has given a relatively uniform distribution of lateral branches along the shoot. This technique allows minimal pruning yet proper limb placement along the leader.

Bend branches flat Cherry trees are very apically dominant which results in upright branch angles. If the branches are spread flat the tips turn up and resume vertical growth. With the Slender Spindle, the Vertical Axis, the Perpendicular V and the Central Leader systems, horizontal branches are critical to producing a conic shaped tree that has good light distribution at maturity. This requires training lateral branches horizontal. Training branches one time as with apple has not been successful with cherry since the lateral branches turn up after they have been trained down. A more successful system has been the use of clothespins when the shoot is first developing. As with apple we recommend installing clothespins when the young lateral shoot is 3-5" long. With the mouth of the clothespin around the leader the tail of the clothespin

pushing the young shoot down to the horizontal. The clothespins are left in this initial position for about 2 weeks, after which they are hung from the young leaves of the developing shoot near the tip. The weight of the clothespin on a young growing shoot keeps it in the horizontal position. The clothespins must be moved further out on the shoot near the tip every 10 days for the months of June and July. This should be repeated in years 1-3 and requires a significant labor commitment to accomplish the job. This will eliminate the need for large bench cuts on scaffold limbs to get horizontal limbs. If additional follow-up limb spreading is necessary limb tying to an anchor is the best method. We use short pieces of conduit pipe pounded in the ground between each tree as the anchor and then tie the branches down using avis strap.

Mature Management Of Sweet Cherries

Mature high density sweet cherry trees on dwarfing rootstocks have 2 major problems: dense canopies with too little light in the lower canopy and excessive crops with small fruit size. Our experience has taught us a few management strategies to overcome these problems.

Aggressive pruning. We suggest that mature trees on Gisela stocks be pruned more aggressively that trees on Mazzard. The pruning must include the removal of most of the fine and shaded wood each year. This wood tends to set very heavily, especially on less vigorous, precocious scion cultivars like Sweetheart and Somerset and on smaller fruited varieties like Kristin and Ulster. In addition medium vigor shoots should be headed by 1/3-1/2 their length. This reduces the amount of crop they will set 2 years later and stimulates additional leaf area to support the crop.

Maintain light exposure of the lower part of the tree. In high density plantings it is very easy to allow very thick canopies to develop. Cherries like apples need good light distribution in the lower part of the canopy to produce good fruit quality and healthy buds for next years crop. Good light exposure of the bottom is best achieved with limb renewal pruning. Removal of 1-2 large limbs in the top or midsection of the tree each year either at bud swell or post harvest will limit the shading of the top of the tree and create light channels down into the canopy. With cherry in contrast to apple it is important to leave a 6" stub when removing these limbs to prevent bacterial canker on the leader. In many cases the 6" long stubs also produce renewal branches. This new fruiting wood produces large size fruit and can be managed as described above using heading cuts each year.

Conclusions

Considering yield, fruit size, soluble solids and gross economic returns, the Vertical axis, Slender spindle and the V-system were the three best systems in this trial. The Spanish Bush may be best suited for U-pick cherry orchards. Several new cherry varieties appear to be adapted to the New York State climate.

High density orchards combined with a group of management strategies we call “The integrated system of sweet cherry production” can result in the consistent production of high quality cherries. The essential points of the integrated system are: High tree densities (>300), dwarfing rootstocks, new varieties, berms and tiling, copper spray programs, minimal pruning during first 4 years and bud removal to obtain branching, limb renewal pruning to improve light distribution within the canopy, aggressive stubbing back pruning to increase fruit size, irrigation, GA sprays for improved fruit firmness, rain protection nets or Ca sprays, bird protection, postharvest hydrocooling and MAP storage bags.

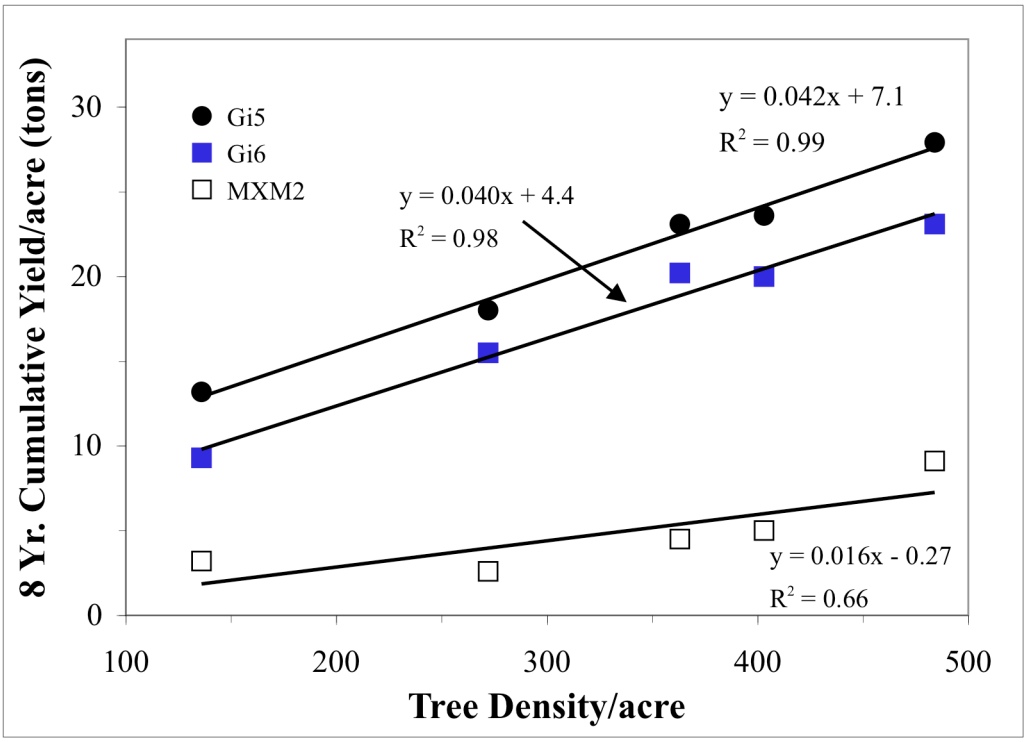

Figure 1. Relationship of tree planting density to cumulative yield of 3 sweet cherry varieties (Hedelfinger, Lapins, Sweetheart) on MXM.2, Gisela 5, and Gisela 6 rootstocks trained to 5 training systems.

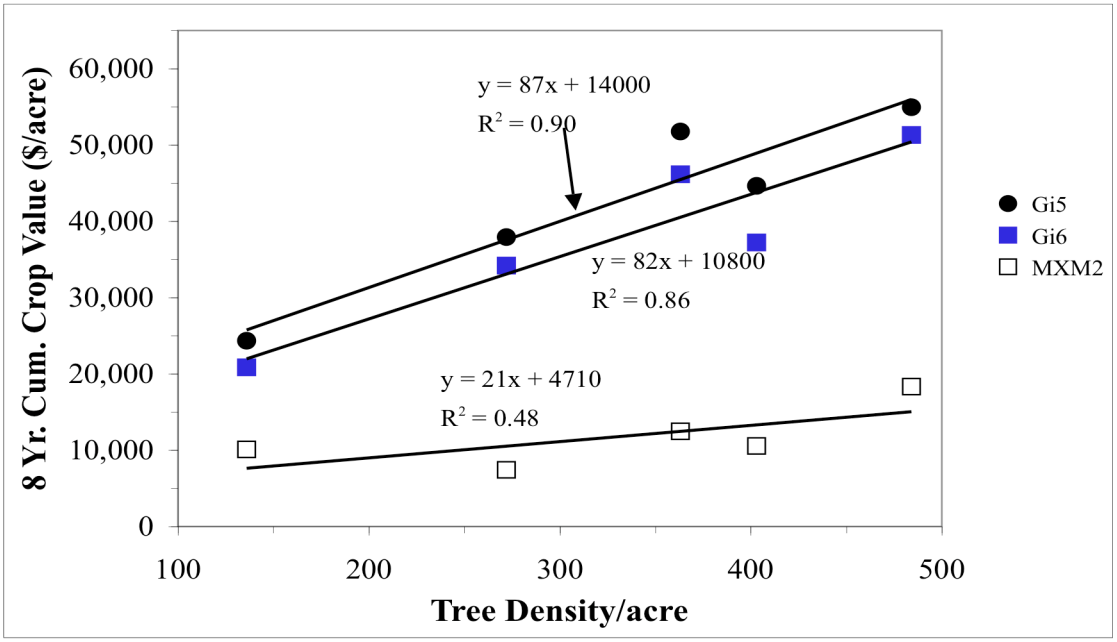

Figure 2. Relationship of tree planting density to cumulative crop value of 3 sweet cherry varieties (Hedelfinger, Lapins, Sweetheart) on MXM.2, Gisela 5, and Gisela 6 rootstocks trained to 5 training systems.